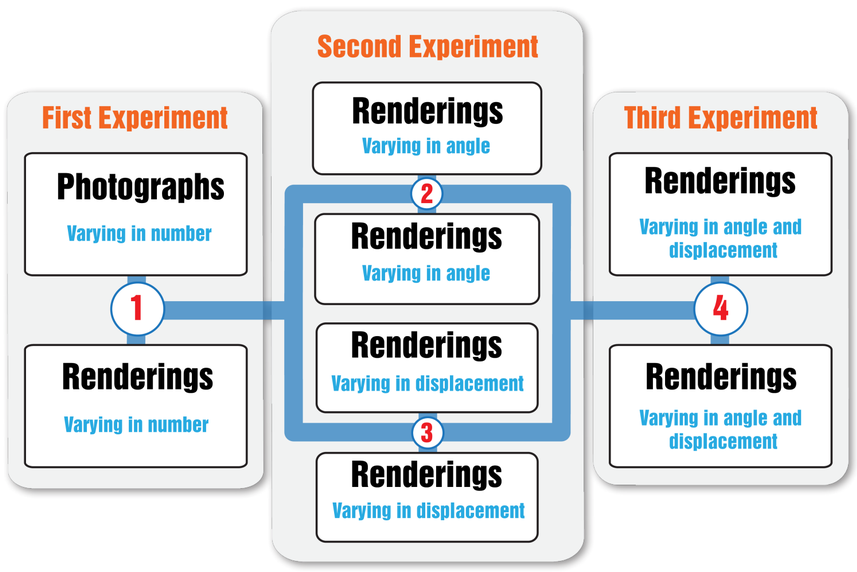
Clutter and Realism

Investigating the effect of clutter on the perceived realism of 3d computer generated renderings.

Philips Research is interested in investigating how well virtual prototypes can be used to predict the outcome of non-virtual tests. For this, we've turned towards identifying a number of features in 3d environments which influence the human perception of realism. This study investigates the effect of object induced clutter and its connection to the perception of visual realism in 3d renderings. This project goes beyond the identification of pre-perceived common trends and reveals the actual perceptual value of clutter according to the perceived realism that it brings to virtual scenes. The project begins with a pre-perceived hypothesis which is:

"The amount of clutter of objects strongly affects the perception of realism in 3d renderings."

There are 3 perceptual experiments incorporated in this study. **For the first experiment** of this project renderings and Tone Mapped HDR photographs are compared and the effect that the number of objects in them has on their visual realism is shown. **For the following stages** renderings are compared between each other and unlike the first experiment where the focus is on the number of objects these contain items varying in angle and placement. **Thus this project includes a total of 4 participant test stages** which test the effect of the number of object, the placement and the angle shift which we argue are the 3 features definitive to object clutter.



This study shows that despite the fact that there is a proven small and consistent rise in realism with the rise of the clutter, that rise is not affected by either the number of objects or their placement in the scene but only by the variable of angle shift. Angle shift under the conditions in which this project took place proved to have a greater effect on the visual perception of realism than the other features of clutter. However the small difference leads us to believe that the perceptual value the angle shift brings to the visual realism of scenes could be even smaller in a none test environment. For virtual prototyping of luminaires the outcome of this project points towards a defened simplification of the scenes used. As the number of object in the scene does not greatly contribute to the perceptual value of the renderings the 3d scenes can be stripped off objects inside them and thus made quicker, with less skill required and eventually rendered faster.

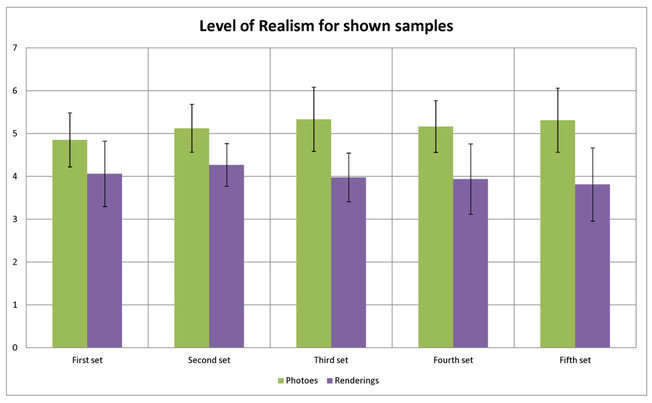
First Experiment Samples


Renderings clutter level 5 (30 objects in scene).


Renderings clutter level 5 (30 objects in scene).

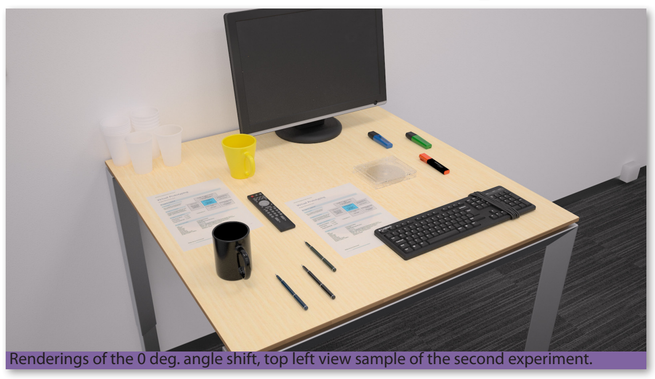
Photography clutter level 5 (30 objects in scene).

Photography clutter level 1 (6 objects in scene).

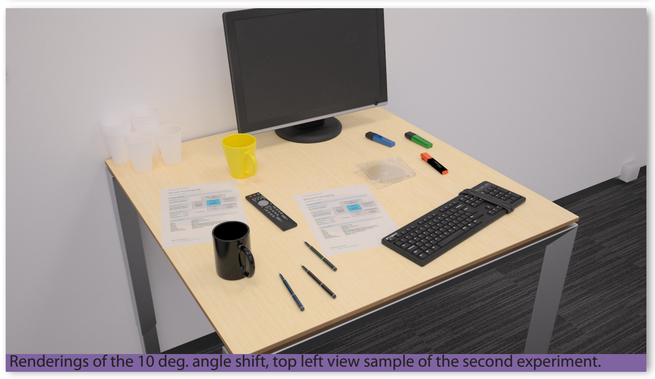


The graph on the left presents the effect that the images shown in the first experiment have on realism. The photography and renderings are compared with each other on the 7 point scale used by the participants in the experiment. The results show that the renderings score consistently lover than the photography which themselves are not affected by clutter.

Second Experiment Samples

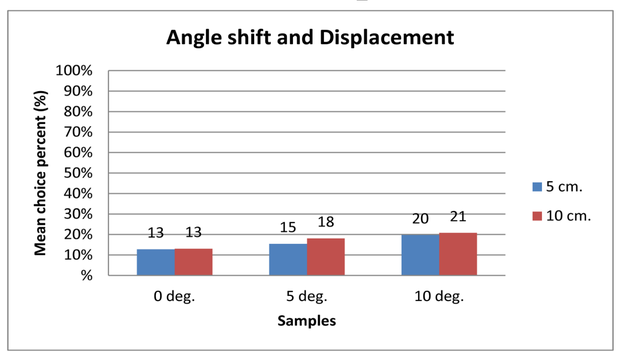

Renderings of the 0 deg. angle shift, top left view sample of the second experiment.


Renderings of the 0 cm. displacement, top left view sample of the second experiment.


Renderings of the 10 deg. angle shift, top left view sample of the second experiment.


Renderings of the 10 cm. displacement, top left view sample of the second experiment.

Third Experiment Conclusions



The graph on the left presents the final outcome of the third experiment. In it you can see the percentage definition of times that a sample was picked in the paired comparison analysis. The participants made these choices on the basis of which image they perceived as more realistic. The rise in realism is small and mostly caused by angle shift.

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24th of April 2012
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